

Chromosome numbers for the Italian flora: I

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Abstract

In this contribution new chromosome data obtained on material collected in Italy are presented. It includes 15 chromosome counts for *Carduus*, *Crepis*, *Picris*, *Taraxacum* (Asteraceae), *Ceratonia*, *Lathyrus* (Fabaceae), *Colchicum* (Colchicaceae), *Fritillaria* (Liliaceae), *Petrorhagia* (Caryophyllaceae), *Potentilla* (Rosaceae), *Quercus* (Fagaceae), *Reseda* (Resedaceae), and *Thymus* (Lamiaceae).

Keywords

Cytogeography, Cytotaxonomy, Karyotype

How to contribute

The text concerning new chromosome data should be submitted electronically to Lorenzo Peruzzi (lorenzo.peruzzi@unipi.it), including indications on voucher specimens and methods used.

Chromosome counts

Carduus personata (L.) Jacq. subsp. *personata* (Asteraceae)

Chromosome number. $2n = 20$ (Fig. 1)

Voucher specimen. ITALY. Toscana. Alpe della Luna, Appennino Aretino, faggeta di crinale del M. dei Frati, 1300–1400 m, 12 July 1988, *M. Raffaelli, M. Rizzotto, A. Maury & A. Formelli* (FI).

Method. Pretreatment of root tips with 8-hydroxyquinoline for 2 h, fixed in Carnoy, hydrolysis in 1N HCl at 60 °C, stain with 40% orcein.

Observations. Sixteen out of 41 specific and subspecific *Carduus* taxa growing in Italy are native to Tuscany. *Carduus personata* is a perennial species occurring in alpine and subalpine areas of central Europe, the Alps, and Carpathian Mountains (Gremaud 1979). It is distributed in northern and central, but not in southern Italy (Conti et al. 2005, Conti and Bartolucci 2013). Several chromosome counts of *Carduus* species are known from the literature (Gremaud 1979, Peruzzi et al. 2015), with occasional occurrence of B-chromosomes. Only a few examples of polyploidy have been reported so far (Gremaud 1979). It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it also represents a new cytotype for the *C. personata*, for which the following chromosome numbers were reported for other countries so far: $2n = 16, 18, 22$ (Rice et al. 2014). The population thriving on the Alpe della Luna occurs mostly on moist rocks or in open spots inside the beech forest. Chromosome size ranges from 1.2 to 2.6 μm .

Carduus nutans L. subsp. *nutans* (Asteraceae)

Chromosome number. $2n = 16$ (Fig. 2)

Voucher specimen. ITALY. Toscana. Alpe della Luna, Appennino Aretino da Pian delle Capanne alla Sella, fra M.te Maggiore e M.te dei Frati a 1000–1350 m, 22 August 1989, *M. Raffaelli & A. Formelli* (FI).

Method. Pre-treatment of root apices with 8-hydroxyquinoline for 2 h, fixed in Carnoy, hydrolysis in 1N HCl at 60 °C, staining with 40% orcein.

Observations. The species *Carduus nutans*, with six subspecies, is widespread throughout the Italian peninsula (Conti et al. 2005). The chromosome number found in plants from Alpe della Luna is the same as that found in plants from other Italian localities (Favarger 1973, Brullo et al. 1978, Bellomaria and Hruska 1983) and from populations of Eastern Europe (Rice et al. 2014). Chromosome size ranges from 2.6 to 2.8 μm .

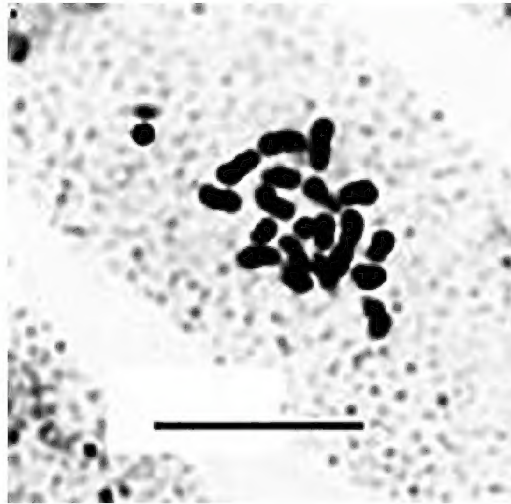


Figure 1. *Carduus personata* (L.) Jacq. subsp. *personata*, $2n = 20$. Scale bar: 10 μm .

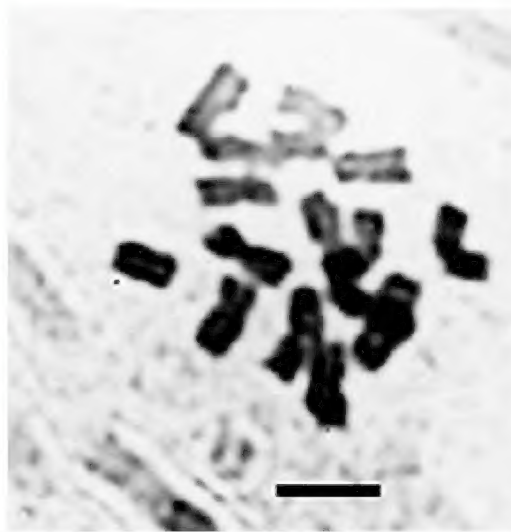


Figure 2. *Carduus nutans* L. subsp. *nutans*, $2n = 16$. Scale bar: 5 μm .

Reseda luteola L. (Resedaceae)

Chromosome number. $2n = 26$ (Fig. 3)

Voucher specimen. ITALY. Toscana. Alpe della Luna (Appennino Aretino), da Pian delle Capanne salendo al crinale di M.te dei Frati, 17 September 1987, *M. Raffaelli & A. Formelli* (FI).

Method. Pre-treatment of root apices with 8-hydroxyquinoline for 2 h, fixed in Carnoy, hydrolysis in 1N HCl at 60 °C, staining with 40% orcein.

Observations. *Reseda luteola* is widely distributed all over the Italian peninsula, Sicily and Sardinia (Conti et al. 2005). The population from Alpe della Luna occurs mostly in dry meadows below 1000 m of elevation (Raffaelli and Rizzotto 1991). It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards). This chromosome number was already reported, as the most frequent, for other countries, together with $2n = 24$, 28 (Fernández-Peralta et al. 1982, Rice et al. 2014). Chromosome size ranges from 1.8 to 3.5 μm .

Colchicum bulbocodium Ker Gawl. subsp. *versicolor* (Ker Gawl.) K.Perss. (Colchicaceae)

Chromosome number. $2n = 22$ (Fig. 4)

Voucher specimen. ITALY. Abruzzo. Campo Felice (Lucoli, L'Aquila), pascoli, 1500 m, 19 May 2006, *F. Conti & R. Soldati* (APP, n. 30130).

Method. Squash preparations were made on root tips obtained from cultivated corms. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. The genus *Colchicum* L. exhibits a wide range of chromosome numbers and ploidy levels, from $2n = 14$ to $2n = \text{ca. } 216$ (Chacón et al. 2014). *Colchicum bulbocodium* subsp. *versicolor* is an east European taxon, occurring in Italy only in Abruzzo, Lazio and Umbria, doubtful in Valle d'Aosta (Conti et al. 2005, Miglio and Santucci 2011, Bovio 2014). It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with previous counts made in other countries (Wetschnig 1992, Persson 2009).

Fritillaria montana Hoppe ex W.D.J.Koch (Liliaceae)

Chromosome number. $2n = 18$ (Fig. 5)

Voucher specimen. ITALY. Abruzzo. Valle del Giovenco (L'Aquila), May 2008, *F. Bartolucci & V. Impiccini* (APP).

Method. Squash preparations were made on root tips obtained from cultivated bulbs. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. The chromosome count found is typical for this species, and was reported for several other localities from Italy and abroad (Bartolucci et al. 2009). Interestingly, $2n = 24$ was published for the same population studied here (Chichiriccò and Tammaro 1982, under the name *Fritillaria orsiniana* Parl.). Bartolucci et al. (2009) did not have the possibility to study these plants, so that the question was left open. Now, it is evident that the count by Chichiriccò and Tammaro (1982) is erroneous and/or referred to another taxon.

Lathyrus pannonicus (Jacq.) Garcke (Fabaceae)

Chromosome number. $2n = 14$ (Fig. 6)

Voucher specimen. ITALY. Abruzzo. Altopiano delle Rocche, nei pressi di Campo di Rovere (Rocca di Mezzo, L'Aquila), 24 May 2006, *F. Bartolucci* (APP, n. 34710).

Method. Squash preparations were made on root tips obtained from cultivated plants. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Car-

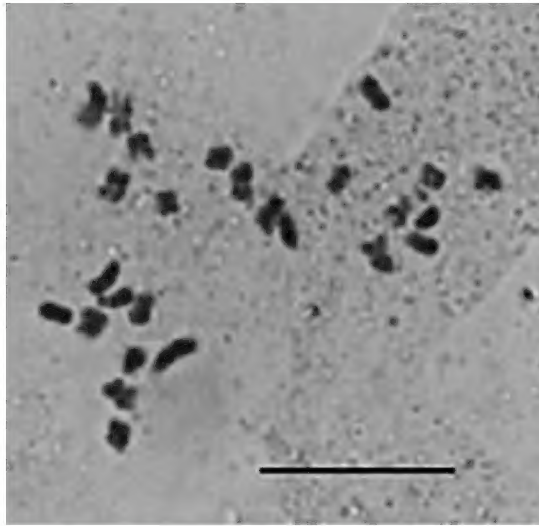


Figure 3. *Reseda luteola* L., $2n = 26$. Scale bar 5 μm .

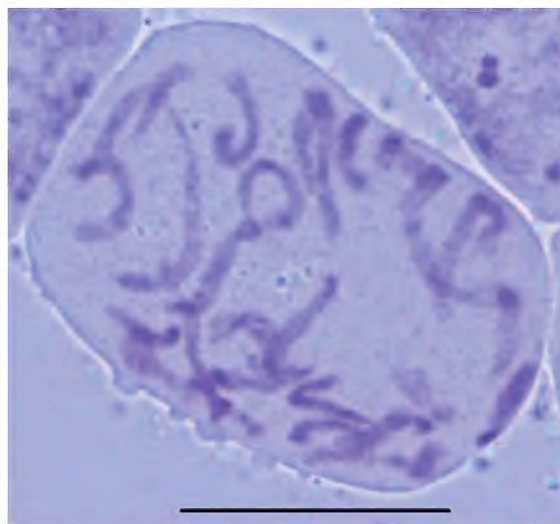


Figure 4. *Colchicum bulbocodium* Ker Gawl. subsp. *versicolor* (Ker Gawl.) K.Perss., $2n = 22$. Scale bar: 10 μm .



Figure 5. *Fritillaria montana* Hoppe ex W.D.J.Koch, $2n = 18$. Scale bar: 10 μm .

noy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. According to Schlee et al. (2011), this population (named “Rovere type”), as well as the populations from the National Park of Abruzzo (Conti and Bartolucci 2015), shows intermediate morphological traits among different subspecies, so



Figure 6. *Lathyrus pannonicus* (Jacq.) Garcke, $2n = 14$. Scale bar: 10 μm .

that it is not possible to safely attribute it to any currently recognised subspecies. It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with previous counts made elsewhere (Rice et al. 2014).

Thymus striatus Vahl subsp. *acicularis* (Waldst. & Kit.) Ronniger (Lamiaceae)

Chromosome number. $2n = 26$ (Fig. 7)

Voucher specimen. ITALY. **Abruzzo.** Feudo d’Ugni, Parco Nazionale della Majella (Pennapiedimonte, Chieti), 2300 m, F. Conti & F. Bartolucci, August 2011 (APP).

Method. Squash preparations were made on root tips obtained from cultivated plants. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. *Thymus straitus* s.l. shows several chromosome numbers, i.e. $2n = 26, 28, 42, 54, 56, 84$ (Bartolucci and Peruzzi 2014 and literature cited therein). The chromosome number found is typical for this subspecies, and was reported for other localities from central Italy (Bartolucci and Peruzzi 2014).

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Ceratonia siliqua L. (Fabaceae)

Chromosome number. $2n = 24$ (Fig. 8)

Voucher specimen. ITALY. **Puglia.** C.da Serranova (Carovigno, Brindisi), nei pressi della masseria Grottamiranda, uliveto misto a *Ceratonia siliqua* su suolo calcareo con roccia affiorante, 68 m, 11 August 2015, F. Roma-Marzio & G. Roma-Marzio (PI).

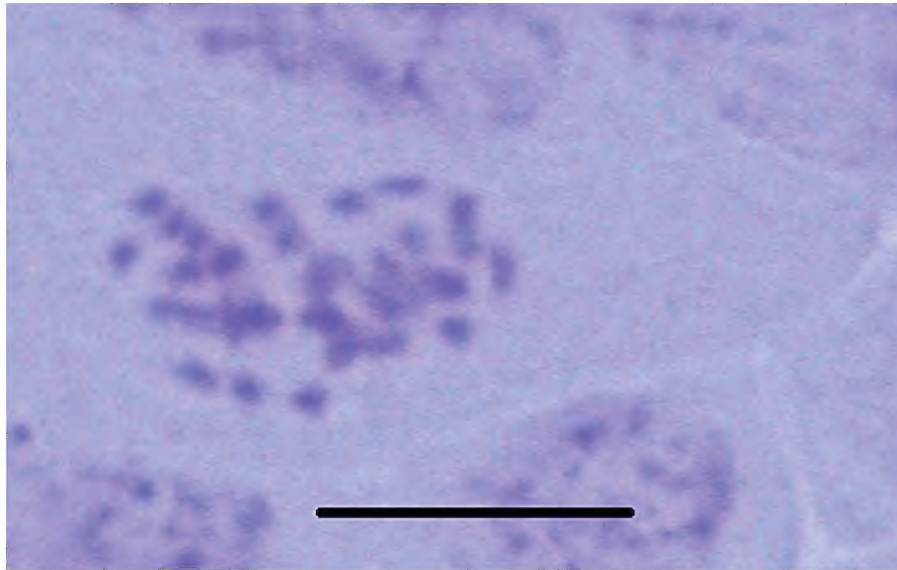


Figure 7. *Thymus striatus* Vahl subsp. *acicularis* (Waldst. & Kit.) Ronniger, $2n = 26$. Scale bar: 5 μm .

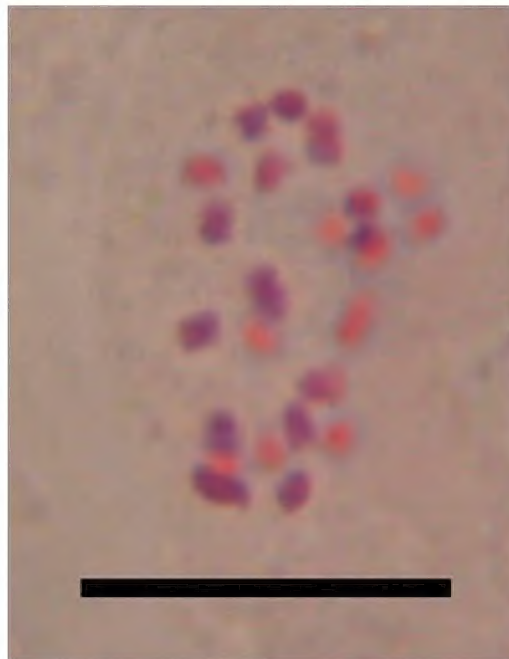


Figure 8. *Ceratonia siliqua* L., $2n = 24$. Scale bar: 10 μm .

Method. Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. *Ceratonia siliqua* is a Mediterranean species, native to Turkey, Cyprus, Syria, Lebanon, Palestine, southern Jordan, Egypt, Tunisia, and Libya; some authors believe that it was probably introduced to Greece, Italy, France, Spain, and Portugal in ancient times (Ballesteros et al. 2015). Conti et al. (2005, 2007), however, report this species as native in all the coastal regions of central-southern Italy, Sardinia, and Sicily. It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with most of the counts made in other countries (Rice et al. 2014), with the exception of two reports ($2n = 36$, $2n = 48$) from Israel (Bureš et al. 2004).

Quercus × *pseudosuber* Santi (Fagaceae)

Chromosome number. $2n = 24$ (Fig. 9)

Voucher specimen. ITALY. Toscana. versante settentrionale del M.te Vitalba, loc. Fontana del Vitalba (Chianni, Pisa), bosco misto su suolo calcareo argilloso, 512 m, 9 December 2015, F. Roma-Marzio & M. D'Antraccoli (PI).

Method. Squash preparations were made on root tips obtained from germinating acorns. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. According to Cristofolini and Crema (2005), the name *Q. ×pseudosuber* Santi should be exclusively applied to the systematic unit occurring from central Tuscany to southern Italy, whereas plants from northern Italy (including N Apennine) and SE France, should refer to the name *Quercus crenata* Lam. In our opinion, the two units can be hardly distinguished morphologically. However, according to Peruzzi et al. (2011), the studied population should be referred to *Q. ×pseudosuber*. It is the second chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with the report published by D'Emérico et al. (1995, under the name *Quercus crenata*) for southern Italy.

Quercus robur L. subsp. *robur* (Fagaceae)

Chromosome number. $2n = 24$ (Fig. 10)

Voucher specimen. ITALY. Toscana. Colline delle Cerbaie, loc. Le Pianore (Castelfranco di Sotto, Pisa), margine di bosco mesofilo, 50 m, 21 October 2015, F. Roma-Marzio & M. D'Antraccoli (absent; acorns collected in the field only).

Method. Squash preparations were made on root tips obtained from germinating acorns. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with other counts from abroad (Rice et al. 2014), confirming the high chromosome number stability in the genus *Quercus* L.

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Crepis rubra L. (Asteraceae)

Chromosome number. $2n = 10$ (Fig. 11)

Voucher specimen. ITALY. Campania. Vallone San Nicola (Trevico, Avellino), prato arido, 710–930 m, 4 June 2015, G. Astuti, L. Peruzzi & F. Roma-Marzio (absent; cypselae collected in the field only).

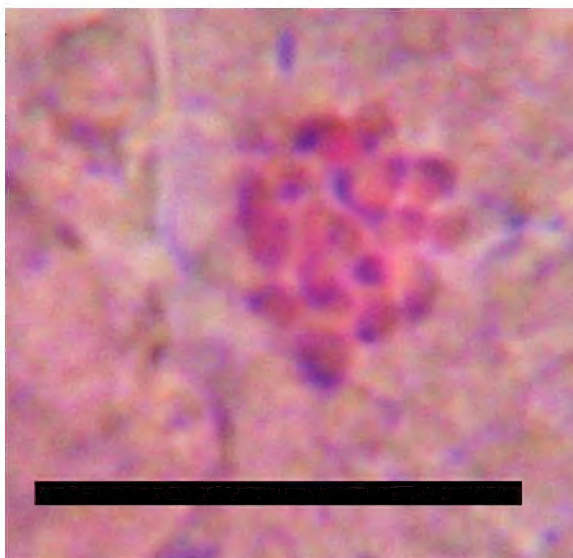


Figure 9. *Quercus x pseudosuber* Santi, $2n = 24$. Scale bar: 10 μm .

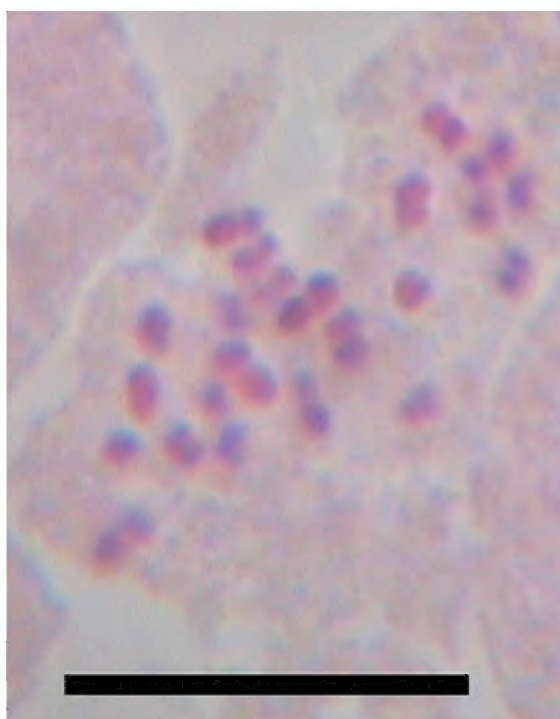


Figure 10. *Quercus robur* L. subsp. *robur*, $2n = 24$. Scale bar: 10 μm .



Figure 11. *Crepis rubra* L., $2n = 10$. Scale bar: 10 μm .

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. *Crepis rubra* is a species with a Mediterranean distribution (Pignatti 1982), occurring in Italy only in Campania, Puglia, Basilicata, and Calabria, doubtful in Molise (Conti et al. 2005). According to a recent taxonomic review of the genus *Crepis* L., based on molecular studies, this species (previously classified within *C. sect. Hostia* (Moench) Babç.) is now placed within *C. sect. Barkhausia* (Moench) Gaudin, along with other taxa previously included within *C. sect. Zacintha* (Mill.) Babç. and *C. sect. Berinia* (Brign.) Babç. (Enke 2009). It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with most of the counts made abroad, even though other chromosome numbers are also reported: $2n = 8$, $2n = 12$, and $2n = 16$ (Rice et al. 2014).

Petrorhagia dubia (Raf.) G.López & Romo (Caryophyllaceae)

Chromosome number. $2n = 30$ (Fig. 12)

Voucher specimen. ITALY. Campania. Vallone San Nicola, Trevico, Avellino, pendio rupestre, 710–930 m, 4 June 2015, G. Astuti, L. Peruzzi & F. Roma-Marzio (PI).

Method. Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. *Petrorhagia dubia* belongs to *P. sect. Kohlrauschia* (Kunth) P.W.Ball & Heywood, which includes annual and self-compatible species characterized by a basic chromosome number $x = 15$ (Thomas and Murray 1983). Our chromosome number report is the first from peninsular Italy, and it agrees with a previous report from Sicily (Colombo and Trapani 1989, under the name *Petrorhagia velutina* (Guss.) P.W.Ball & Heywood) and with counts made elsewhere (Thomas and Murray 1983, Diaz Lifante and Parra Martin 2013, Rice et al. 2014).

Picris hieracioides L. subsp. *hieracioides* (Asteraceae)

Chromosome number. $2n = 10$ (Fig. 13)

Voucher specimen. SAN MARINO. San Marino, Monte Titano, sentiero roccioso sotto la torre “il montale”, 19 August 2014, D. Dolci (PI).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.



Figure 12. *Petrorhagia dubia* (Raf.) G.López & Romo, $2n = 30$. Scale bar: 10 μm .



Figure 13. *Picris hieracioides* L. subsp. *hieracioides*, $2n = 10$. Scale bar: 10 μm .

Observations. In Italy, the genus *Picris* L. includes four species and only two subspecies are currently recognized within *P. hieracioides* (Slovák et al. 2012, Astuti et al. 2015). Our chromosome count agrees with other data from Italy and elsewhere (Slovák et al. 2007, Bedini et al. 2010 onwards, Rice et al. 2014, Astuti et al. 2015).

Potentilla pedata Willd. ex Hornem. (Rosaceae)

Chromosome number. $2n = 28$ (Fig. 14)

Voucher specimen. ITALY. Basilicata. versante lucano del Monte Sparviere (Terranova del Pollino, Potenza), pascolo, 1547 m, August 2015, F. Roma-Marzio & L. Peruzzi (PI).

Method. Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy

solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. This species was recently recorded for the locality studied by Roma-Marzio et al. (2016), and it is currently reported for most of the Italian regions (Falcinelli et al. 2015 and literature cited therein). It is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with counts made on Hungarian plants (Borhidi 1968, under the name *P. pedata* var. *pseudopedata* Borhidi). However, plants from Bulgaria were reported as having $2n = 35, 49, 56$ chromosomes (Markova and Goranova 1996).

Taraxacum olivaceum Soest (Asteraceae)

Chromosome number. $2n = 32$ (Fig. 15)

Voucher specimen. ITALY. Toscana. Monte Prato Fiorito (Bagni di Lucca, Lucca), versante N-NE, prato al margine di bosco, 1117 m, 20 May 2015, F. Roma-Marzio, M. D'Antraccoli, G. Astuti & L. Peruzzi (PI).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsin.

Observations. This species belongs to *Taraxacum* sect. *Palustria* (H.Lindb.) Dahlst. and it was identified according to the multi-access key published by Kirschner and Štěpánek (1998). Our chromosome count is the second one for Italy (Bedini et al. 2010 onwards); it agrees with that published by Aquaro et al. (2010), from Tuscany and with earlier counts made abroad (Kirschner and Štěpánek 1998).

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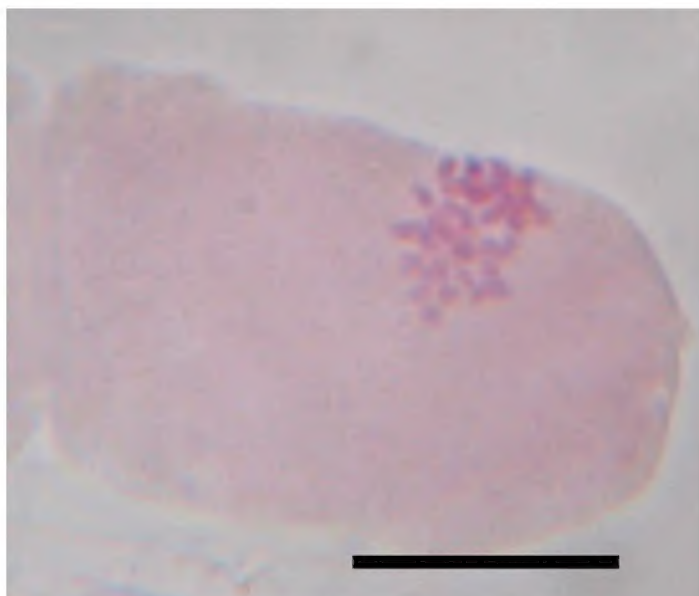


Figure 14. *Potentilla pedata* Willd. ex Hornem., $2n = 28$. Scale bar: 10 μm .

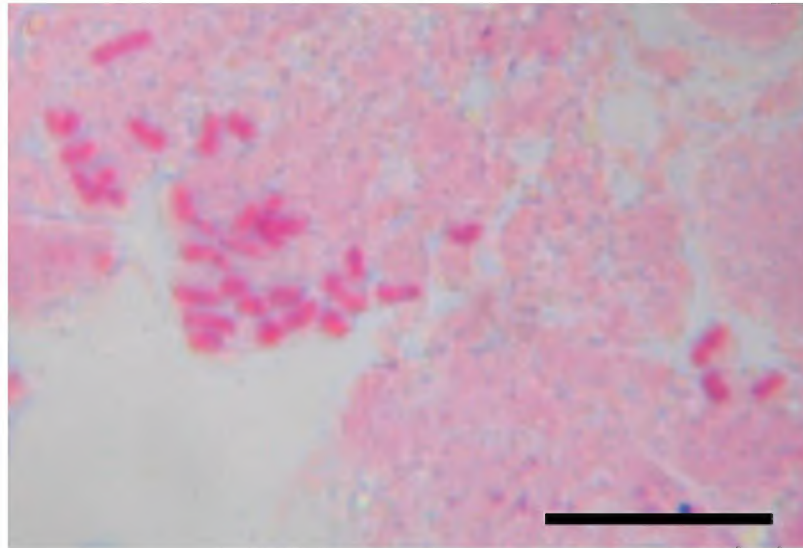


Figure 15. *Taraxacum olivaceum* Soest, $2n = 32$. Scale bar: 10 μm .

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